Safe Flight 21
Cost-Benefit Subgroup
Pre-Investment Analysis Cost Benefit Analysis Phase II Report
Results Briefing

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ASD-410

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Disclaimer

- *The output of this effort is the Safe Flight 21 Pre-Investment Analysis Cost Benefit Analysis Phase II Report. It should be noted that this report, its findings and assumptions do not imply any commitment by the FAA. The numbers reported in the report are based on high-level assumptions developed by the cost/benefit group prior to a rigorous mission and requirements analysis to support it.*

Outline

- SF21 Cost Benefit Overview
  - Goals
  - Challenges
  - Approach
  - Schedule
- Assumptions and Scope
- SF21 Phasing Schedule
- Cost Update
- Equipage Update
- Benefit Update
- Sensitivity Analysis
- Issues and Next Steps
- Team Members

Goals

- Refine Limited Deployment cost and benefit estimates in preparation for the Limited Deployment JRC Decision.
  - refine/validate all Phase 1 ROM assumptions to reduce uncertainty.
  - analyze additional enhancements and benefit metrics
  - coordinate with the Operation Evaluation Team, Capstone effort in Alaska and Europe.
- Provide support to Link technology decision.
- Begin initial cost/benefit estimates for NAS-Wide deployment.
- Order of Priorities
  - Quantify benefits with a focus on the Air-to-air component
  - Translate benefits to the NAS
  - Avionics costs
  - Costing ground components
  - A typical airport cost
  - B/C ratio

Challenges

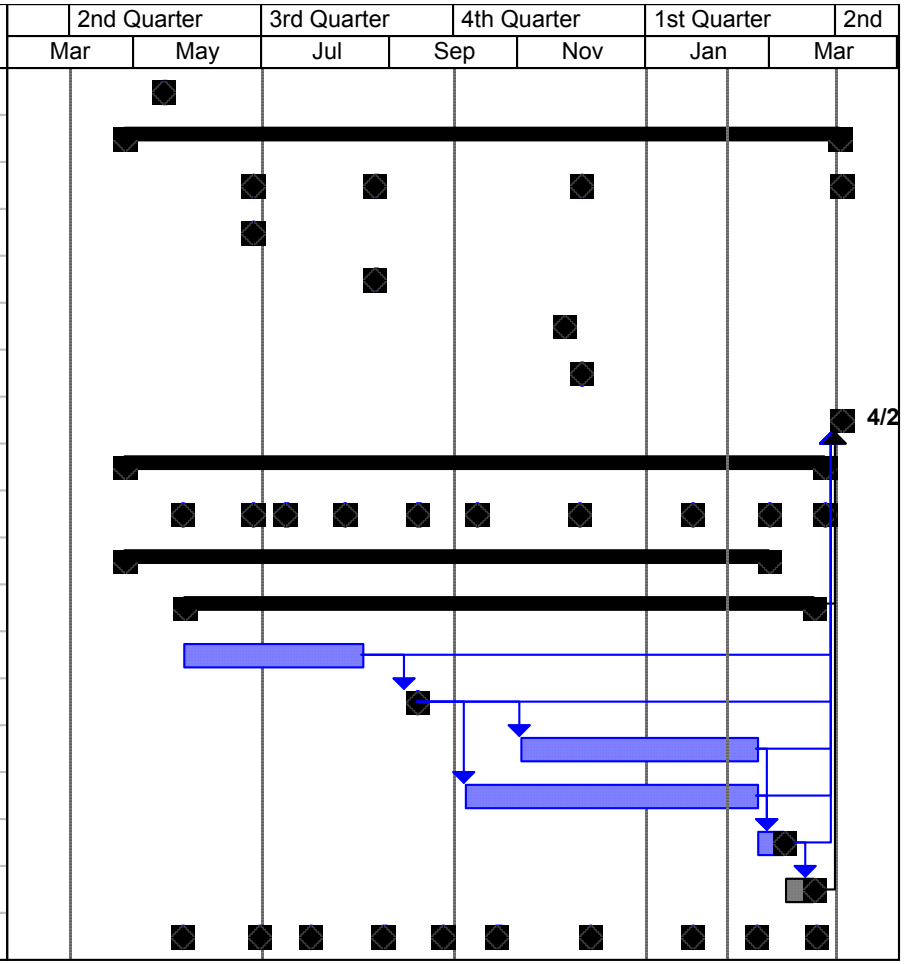
- Coordination required among several geographically disperse individuals with many other obligations
- Need Buy-in from Industry and FAA Leadership on NAS-wide Operational concept.
  - NAS-Wide Architecture is not currently defined
- Tight schedule for completion of milestones
- Availability of data
- Availability of business cases for CAA and the airlines
- Formulation of GA equipage estimate for Alaska
- Coordination with DoD for ADS-B

Approach

- Obtain early buy-in on scope and project schedule
- Assign Roles and Responsibilities
- Work towards team milestones
- Coordinate with SF21 Steering Group
- Document all milestones and data collection efforts
- Coordinate with the OCG (OpEval Coordination Group)
- Coordinate with EuroControl
- Coordinate with the Capstone program
- Fully Document the Team's findings and basis of estimates

Project Schedule

ID	Task Name
1	**Kickoff Meeting- Assign R & R and agree on Scope**
2	**Review and refine findings**
3	**Present Findings at Interim Milestones**
4	1) Initial Status Report and Work Plan
5	2) OpEval 2 Coord. Plan
6	3) B/C Interim Review
7	4) Report Assumption Ranges & Draft Ph 2 Rpt
8	5) Final Phase 2 Report
9	Coordinate and Report Information Gathering
10	Del Monthly Findings summary (working doc)
21	Coordinate w/ OCG, Capstone & Eurocontrol
31	**Develop Cost-Benefit NAS-Wide Estimates**
32	Refine and Expand Phase I estimate
33	Draft Cost Benefit Estimate Interim Report
34	Develop Cost Ranges and Document BOE
35	Develop Benefit Ranges and Document BOE
36	Develop and Report Economic Analysis Results
37	Preliminary Recommendations for LD locations
38	**Monthly Status Report**



Important Assumptions and Scope

- Limited Deployment: will be implemented between 2002 and 2006
  - based on the architecture defined by the SF21 test areas for the Ohio River Valley locations of Memphis and Louisville, and Capstone for AK
- Capstone will include state-wide coverage for AK
- NAS-Wide will be implemented in 2006 with incremental installation of ground stations over a 10 year period
- Estimates will cover the years 2002 to 2025
  - analysis will assume that the current ground infrastructure will be maintained through 2025
- Schedule for applications has be refined to reflect grouping in 2004,2006, and 2010.
- All of the link options will provide full capability for the SF 21 applications

Revised Implementation Schedule

Application	Benefits Quantified	NAS & ORV 2/13 update	AK
1.1.1	Yes	2006	2001
1.1.2	Yes	2008	2008
2.1	Yes	2002	2002
2.2	Yes	2004	2004
3.1.1	No	2002	2002
3.1.2	Yes	2006	2006
3.1.3	Yes	2006	2006
3.2.1	Yes	2006	2006
3.2.2	Yes	2010-2012	2010-2012
3.4	No	2004	2004
4.1.1	Yes	2002	2002
4.1.2	Yes	2006	2006
4.2.1	Yes	2002	2002
4.2.2	Yes	2004	2004
5.2.1	No		
6.1.1	Yes	2004	2004
6.1.2	Yes	2006	2006
6.2	Yes	2002	2002
7.1	Yes	2006	2006
7.2	Yes	2006	2006
8.1	No	2006	2006
8.2	Yes	2006	2001
8.3	No	2006	2006
9.1.1	No	2010	2010
9.2.1	No	2010	2010

Note: Benefits accrual begins based on the latest date of application availability, user equipage, and commissioning of necessary ground equipment

Cost Accomplishments

- Completed all cost models
  - ORV
  - CONUS
  - Alaska Capstone
- Completed Sensitivity Analysis on Equipage
- Completed cost assessment on link options
- Completed documentation of all basis of estimates
  - See appendix section of the document

Equipage Update

- Established equipage models for GA and Air Taxi and for Air Carrier for range of avionics costs
  - NAS-wide
  - ORV
  - Capstone
- Built curves in Analytica for the cases of
  - Independent equipage (benefit to be realized when only one is equipped)
  - Dependent equipage (both aircraft must be equipped to realize benefit)
  - Mixed equipage (ADS-B equipped aircraft can benefit if other aircraft is transponder equipped)

CONUS Equipage

Existing Equipment	Population Percentage	Equipage Assumptions Initial Air-to-Air	Additional Ground Stations	Total	Overall Equipage Level
Transponder and Precision Equipment	69.0%	15.0%	40.0%	55.0%	38.0%
Transponder Only	13.6%	5.0%	30.0%	35.0%	4.8%
No Transponder	17.4%	0.0%	0.0%	0.0%	0.0%
Total	**100.0%**				**42.7%**

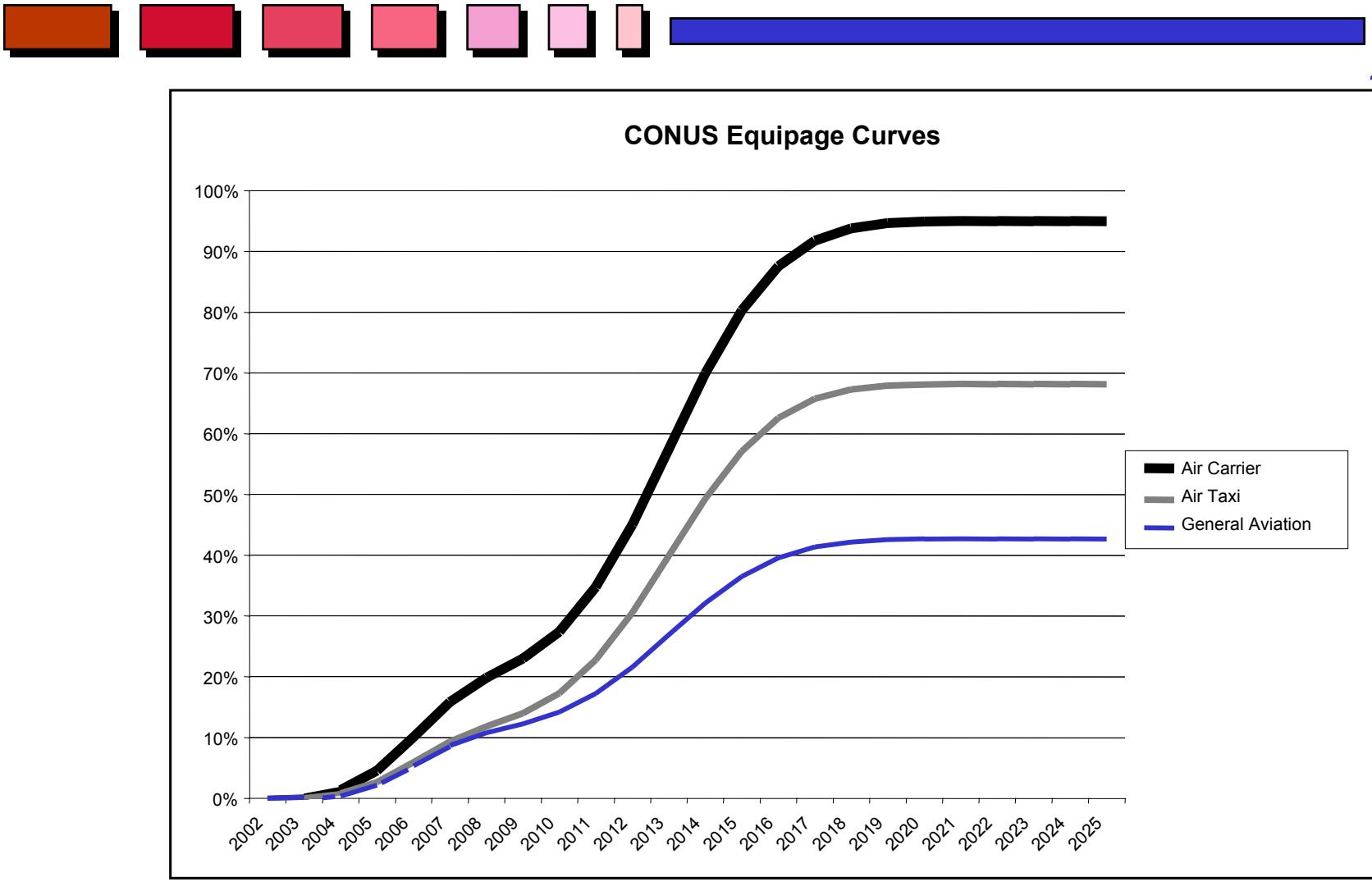
GA Equipage Assumptions

Existing Equipment	Population Percentage	Equipage Assumptions Initial Air-to-Air	Additional Ground Stations	Total	Overall Equipage Level
Transponder and Precision Equipment	69.0%	15.0%	70.0%	85.0%	58.7%
Transponder Only	13.6%	10.0%	60.0%	70.0%	9.5%
No Transponder	17.4%	0.0%	0.0%	0.0%	0.0%
Total	**100.0%**				**68.2%**

Air Taxi Equipage Assumptions

- For Air Carrier operators, a total of 95% of the aircraft are assumed to equip. An initial 20% is expected solely based on air-to-air capabilities. An additional 75% is assumed to be motivated to equip due to the ground station installations

CONUS Equipage Curves



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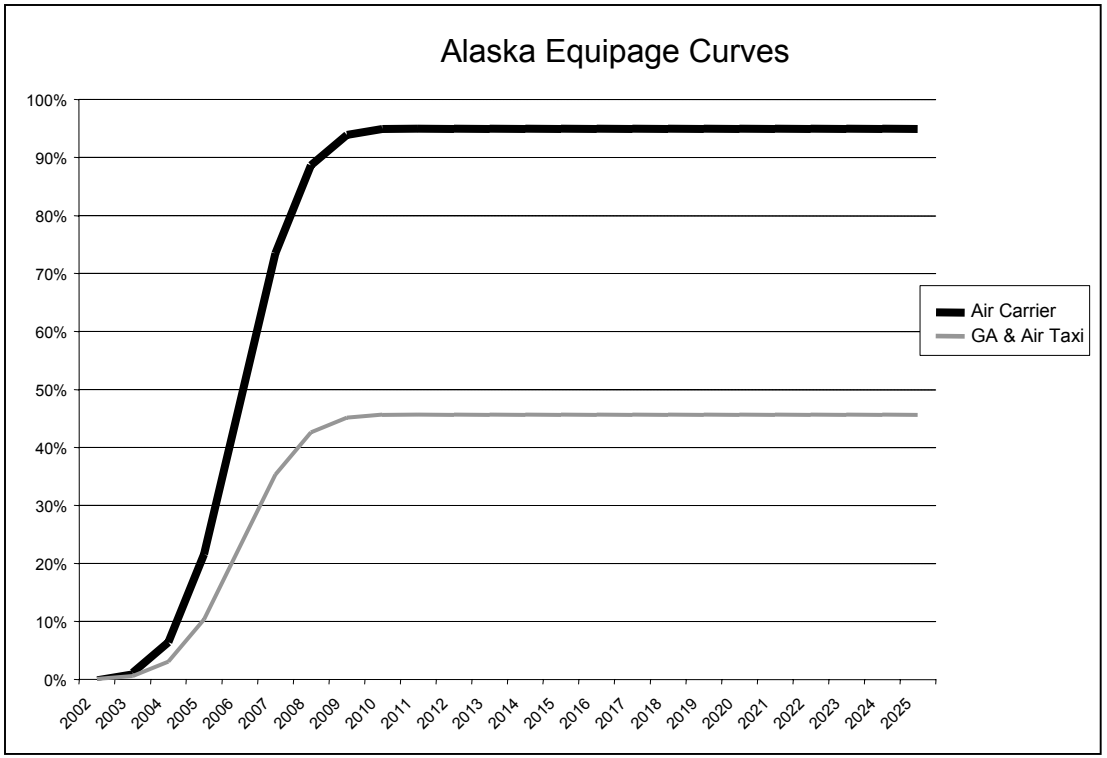
Phase 2

Capstone Equipage

Existing Equipment	Population Percentage	Equipage Assumptions Initial Air-to-Air	Additional Ground Stations	Total	Overall Equipage Level
Transponder and Precision Equipment	32.4%	10.0%	65.0%	75.0%	24.3%
Transponder Only	17.9%	5.0%	45.0%	50.0%	9.0%
No Transponder	49.7%	0.0%	25.0%	25.0%	12.4%
Total	**100.0%**				**45.7%**

GA and Air Taxi Equipage

- Air carrier operators will equip at a level consistent with what is estimated for the CONUS.



Benefits Update

- Finalized and coordinated safety benefit models for
  - 1 Weather information in the cockpit
  - 2 CFIT
  - 4 Improved situational awareness
  - 6 Runway and final approach occupancy awareness
  - 7 Enhanced surface surveillance
- Developed efficiency benefit models for
  - 1 En route savings
  - 3 Reduction in MVFR arrival delays
  - 3/7 Approach spacing
  - 6 Reduction in taxi times
- Coordinated benefits approach with EuroControl

CONUS Sensitivity Analysis

Item	Pessimistic	Point Estimate	Optimistic
FAA Costs	$745.4	$745.4	$745.4
Industry Costs	$2,592.7	$2,664.9	$3,229.5
Total Costs	$3,338.2	$3,410.4	$3,974.9
Safety Benefits	$834.0	$2,101.0	$3,876.0
Efficiency Benefits	$1,488.0	$2,458.0	$3,411.0
Total Benefits	$2,322.0	$4,559.0	$7,287.0
Net Present Value	($1,016.1)	$1,148.6	$3,312.1
B/C Ratio	0.70	1.34	1.83

- *Pessimistic case assumes a higher unit avionics cost and reduced equipage from 95% to 65% for 121s and 50% less for all others and a reduction in effectiveness by 25%*
- *Optimistic case assumes the same unit avionics cost and improved equipage and effectiveness assumption to halfway between current rate and the maximum value for each assumption*

Alaska Sensitivity Analysis

Item	Pessimistic	Point Estimate	Optimistic
FAA Costs	$165.9	$165.9	$165.9
Industry Costs	$77.3	$91.1	$121.0
Total Costs	$243.2	$257.1	$286.9
Safety Benefits	$111.6	$284.2	$532.7
Efficiency Benefits	$14.7	$31.1	$51.7
Total Benefits	$126.3	$315.3	$584.3
Net Present Value	($117.0)	$58.2	$297.4
B/C Ratio	0.52	1.23	2.04

- *Pessimistic case assumes a higher unit avionics cost and reduced equipage from 95% to 65% for 121s and 50% less for all others and a reduction in effectiveness by 25%*
- *Optimistic case assumes the same unit avionics cost and improved equipage and effectiveness assumption to halfway between current rate and the maximum value for each assumption*

Link Assessment

- Avionics Costs

Current Year ($K)	1090	UAT	VDL4	1090/UAT	1090/VDL4
NAS-Wide Industry Avionics Equipage	**$7,849,303**	**$8,307,959**	**$8,721,224**	**$9,437,142**	**$9,671,949**
Part 121 Aircraft	$4,547,290	$5,017,716	$5,170,946	$5,338,319	$5,345,896
Part 135 Aircraft	$857,774	$846,005	$899,391	$982,017	$1,002,598
Part 91 Aircraft	$2,364,589	$2,364,589	$2,571,237	$3,037,157	$3,243,805
Simulator Upgrades	$55,006	$55,006	$55,006	$55,006	$55,006
Certification Costs	$24,643	$24,643	$24,643	$24,643	$24,643

- Ground Costs

Current Year ($K)	1090	UAT	VDL4	1090/UAT	1090/VDL4
F&E	$1,474,520.5	$1,477,552.5	$1,474,520.5	$1,580,114.3	$1,577,082.3
Spectrum Changes	$0.0	$2,756.3	*	$2,756.3	*
Other	$1,474,520.5	$1,474,796.1	$1,474,520.5	$1,577,357.9	$1,577,082.3
O&M	$642,579.4	$642,579.4	$642,579.4	$642,972.2	$642,972.2
Total	**$2,117,099.9**	**$2,120,131.9**	*	**$2,223,086.4**	*

  - *Costs for VDL 4 spectrum change within our assumed schedule were non-quantifiable. VDL 4 could not be implemented within our assumed time frame. The full cost and benefit impact of VDL Mode 4 options could not be quantified within the framework of this study.*

Data Link Discussions

Item	1090	UAT	1090-UAT
FAA Costs	$745.4	$747.5	$793.3
Industry Costs	$2,664.9	$2,811.3	$3,221.9
Total Costs	$3,410.4	$3,558.8	$4,015.2
Safety Benefits	$2,101.0	$2,101.0	$2,101.0
Efficiency Benefits	$2,458.0	$2,458.0	$2,458.0
Total Benefits	$4,559.0	$4,559.0	$4,559.0
Net Present Value	$1,148.6	$1,000.2	$543.8
B/C Ratio	1.34	1.28	1.14

- VDL Mode 4 options omitted due to spectrum change requirements effect on schedule -- further analysis of costs and benefits impacts required.
- Link Assessment Report shows that no single link can provide all the functionality assumed in benefits estimate -- further analysis of cost and benefit impacts required

Issues

- Obtaining Business Cases from airlines.
  - Business cases are proprietary and may not add any additional benefits
- How these results will be transitioned to future planning efforts
- Accuracy of planning scenarios
- Several unknowns about costs, capabilities, schedules for implementations, and benefits of SF 21 applications exist
  - We will learn more from the Operational Evaluations in the Ohio River Valley and the Capstone program in Alaska.
  - We continue coordinating with and learning from EuroControl.
  - We still need to learn more from the air carriers and general aviation community

Next Steps

- As we gain new understandings on avionics costs and equipage, it needs to be incorporated into the models developed for the Phase II report.
- New findings need to be incorporated into the cost and benefits models developed under this Phase II effort.
- **To conclude, this report and its associated models are a starting point to future ADS-B and SF 21 planning efforts.**
  - As more is learned about the performance of the SF 21 applications and how they will fit in with other planning efforts, the inputs to the models can be refined to reflect the future planning assumptions.

Phase 2 Core Team

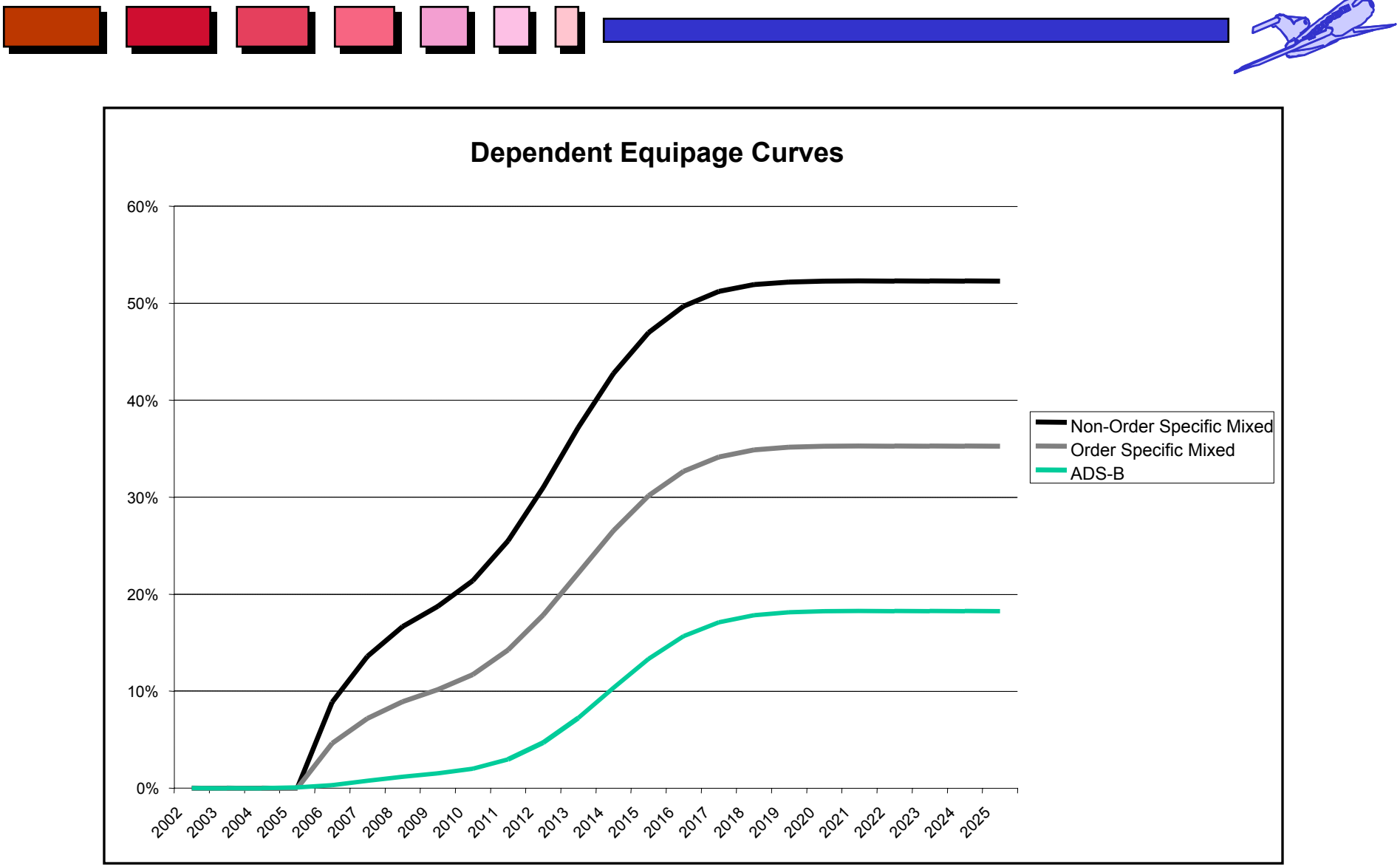
- Co-Lead: Anne Rurup (ASD-410)
- Industry Co-Lead: Jim Walton (UPS)
- IPT Lead: Paul Fontaine (AND-510)
- Advisor: Fran Melone (ASD-430)
- AND-510 Cost Lead: Bert Rogers (MCR Federal)
- NAS Architecture and ADS-B POC: Jim Baird (ASD-140)
- Benefits Lead: Gary Paull (MCR Federal)
- Terminal Enhancements Benefits Lead: Nastaran Coleman (ASD-430)
- Surface Enhancements Benefits Lead: Evan Soffer (ASD-400)
- Alaska: Jim Hebert (AND-510/Contractor support)
- IPT Liason: Robert Nichols (AND-510)
- Air Traffic POC: Keith Dutch (ATP-410)
- Flight Standards POC: Garret Livack (AFS-430)

Additional Key Members

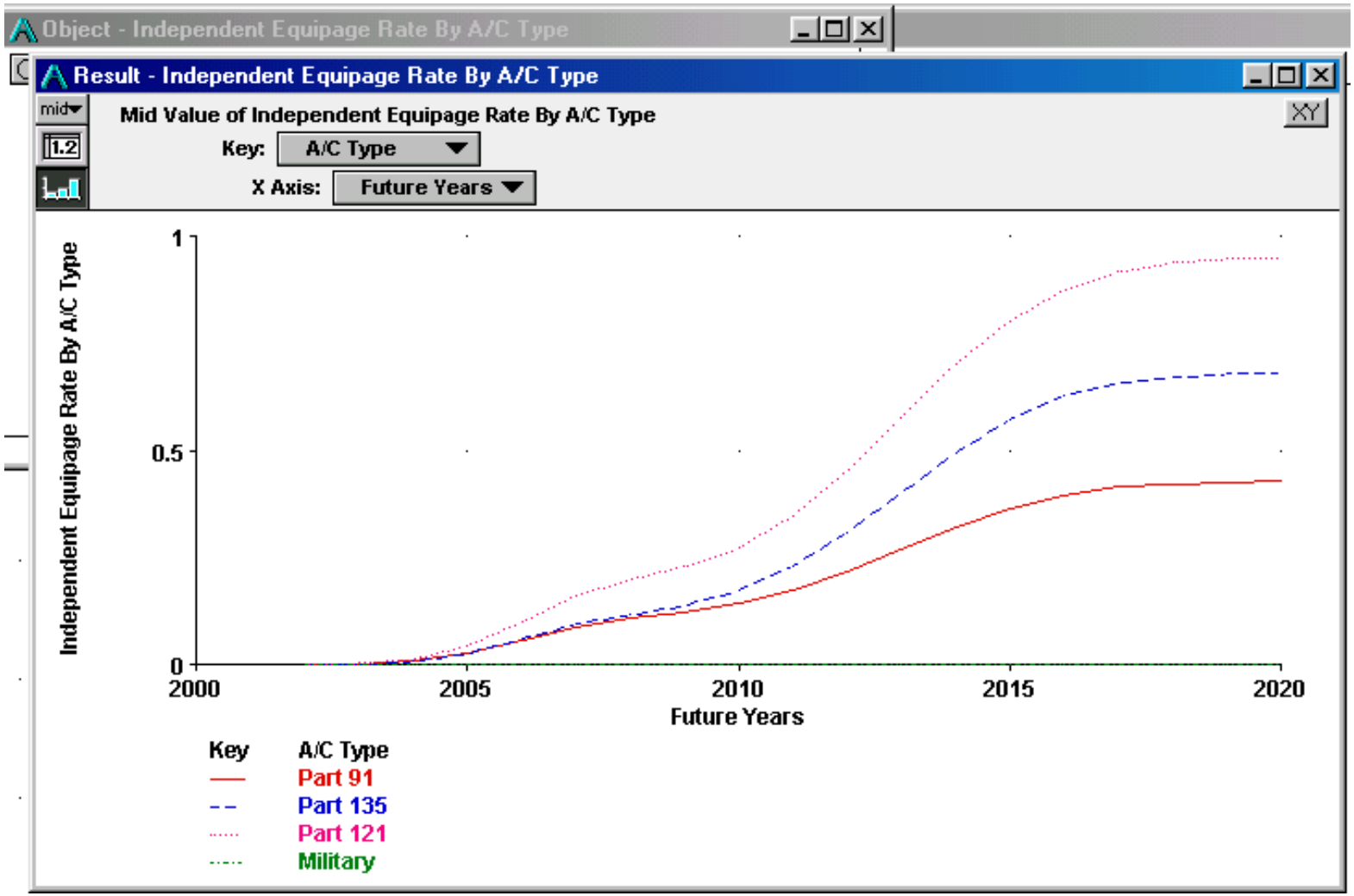
- GA Survey contact: Randy Kenagy (AOPA)
- Requirement: James Sizemore (ARR-100)
- Inter. Rep.: Robert Schickling (DFS Liaison Officer, AND-510)
- MCR Federal Analysis Support: Annette Barlia
- MITRE Experts: Worth Kirkman, Ed Hahn, Jim Cieplak, Oscar Olmos
- Metrics: Jack Pekins, Jim Poage, and Bob Philips (VOLPE)
- Executive Committee: Mark Detroit (ABX), Terry Timmons (FedEx), and Capt. Karen Lee (UPS)
- Operational Evaluation: Jim McDaniel (AND-530)
- Alaska POC: Gary Childers (AAL-2S)
- OCG POCs: Joel Murdock (FedEx), Oscar Olmos (MITRE), Jim Walton (UPS)
- OCG Cost/Benefit Subgroup : A. Rurup and G.Paull: (Co-Chairs)
  - Members: Michael McNeil (ACT-310), Ed Hahn (MITRE), Jack Pekins and Bob Philips (VOLPE), Nick Talotta (ACT-350), Gary Livack (AFS-430)

BACKUP SLIDES

Dependent Equipage Curves Example



Independent NAS-Wide Equipage



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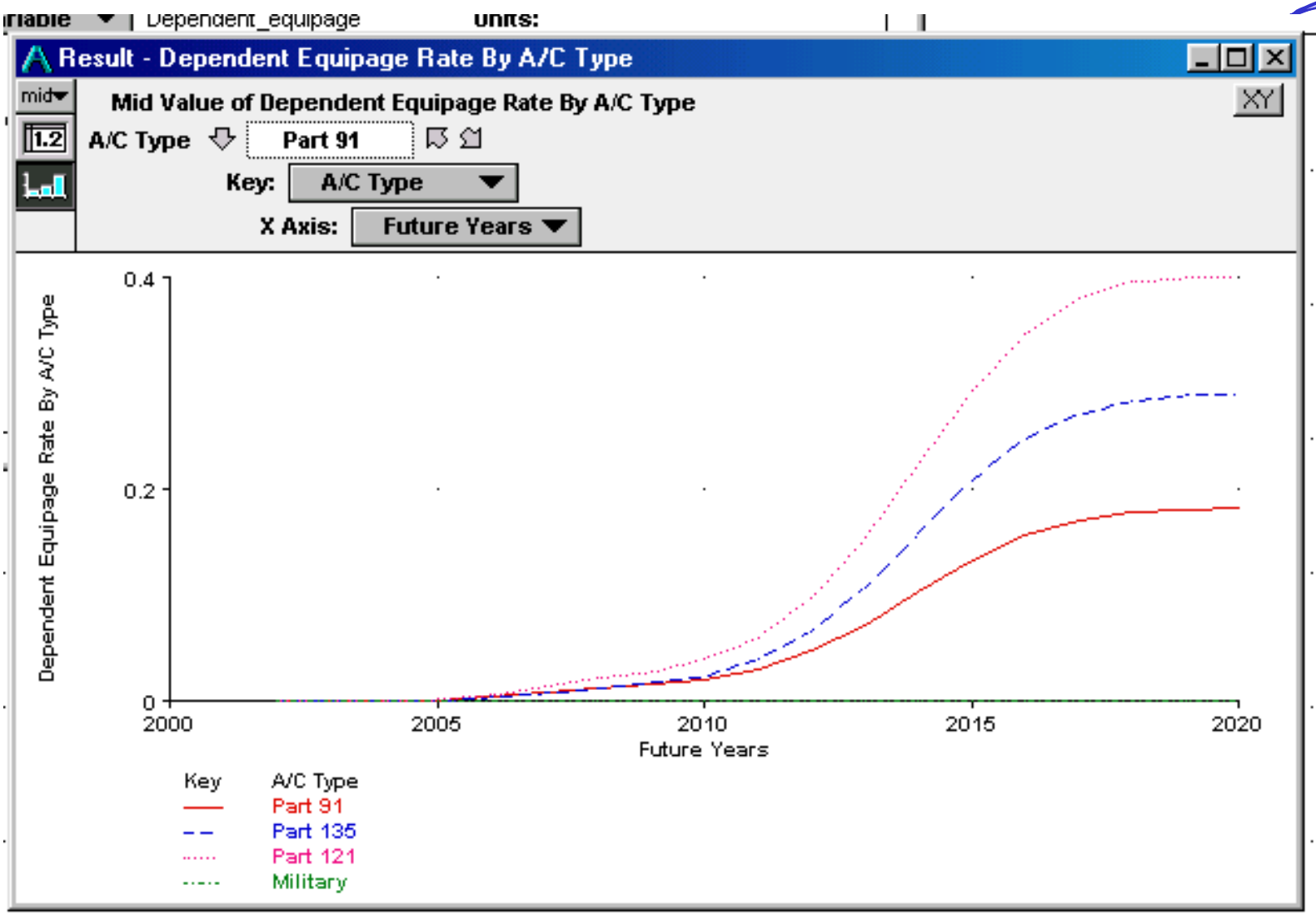
Dependent NAS-wide Equipage for Part 91



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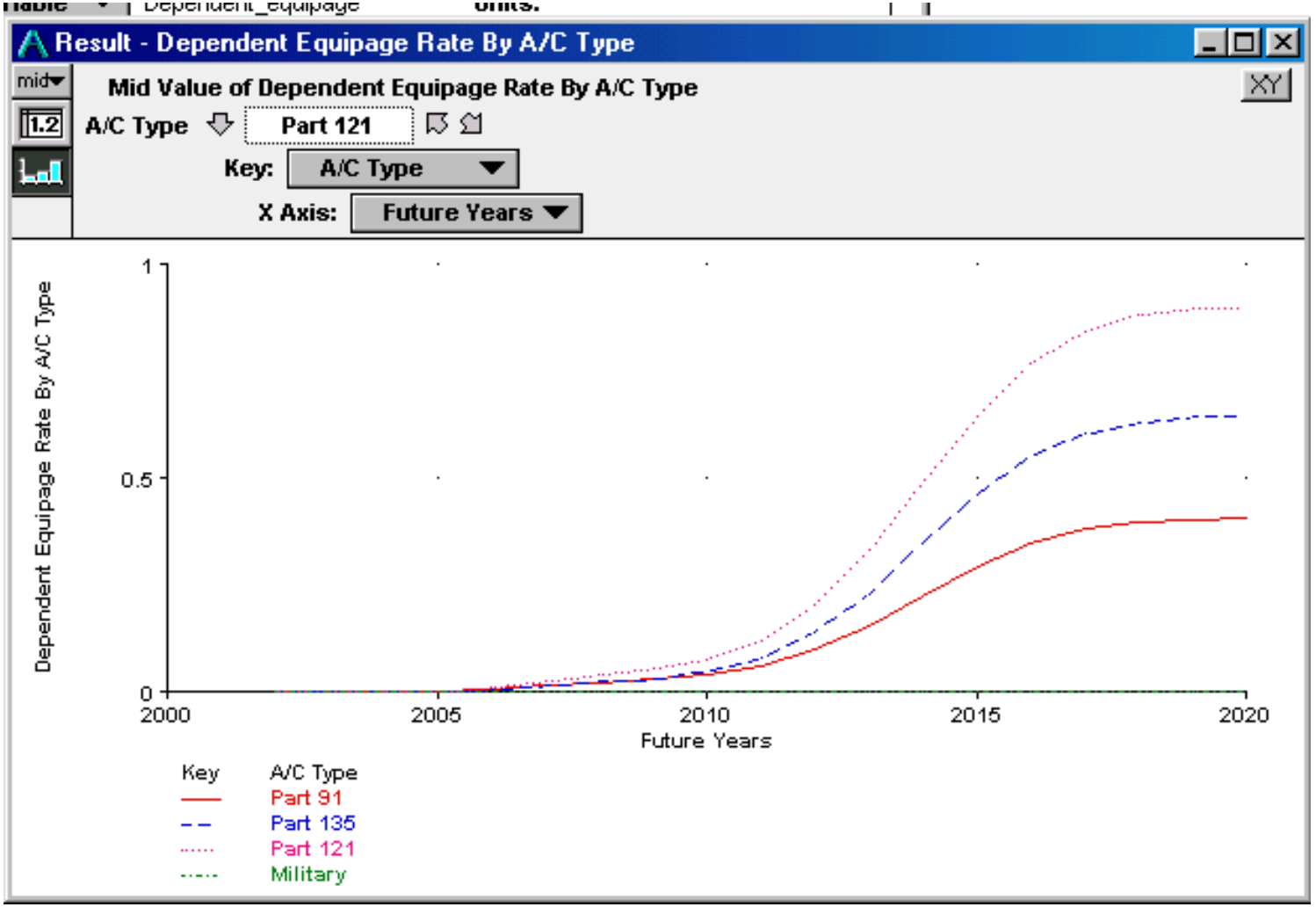
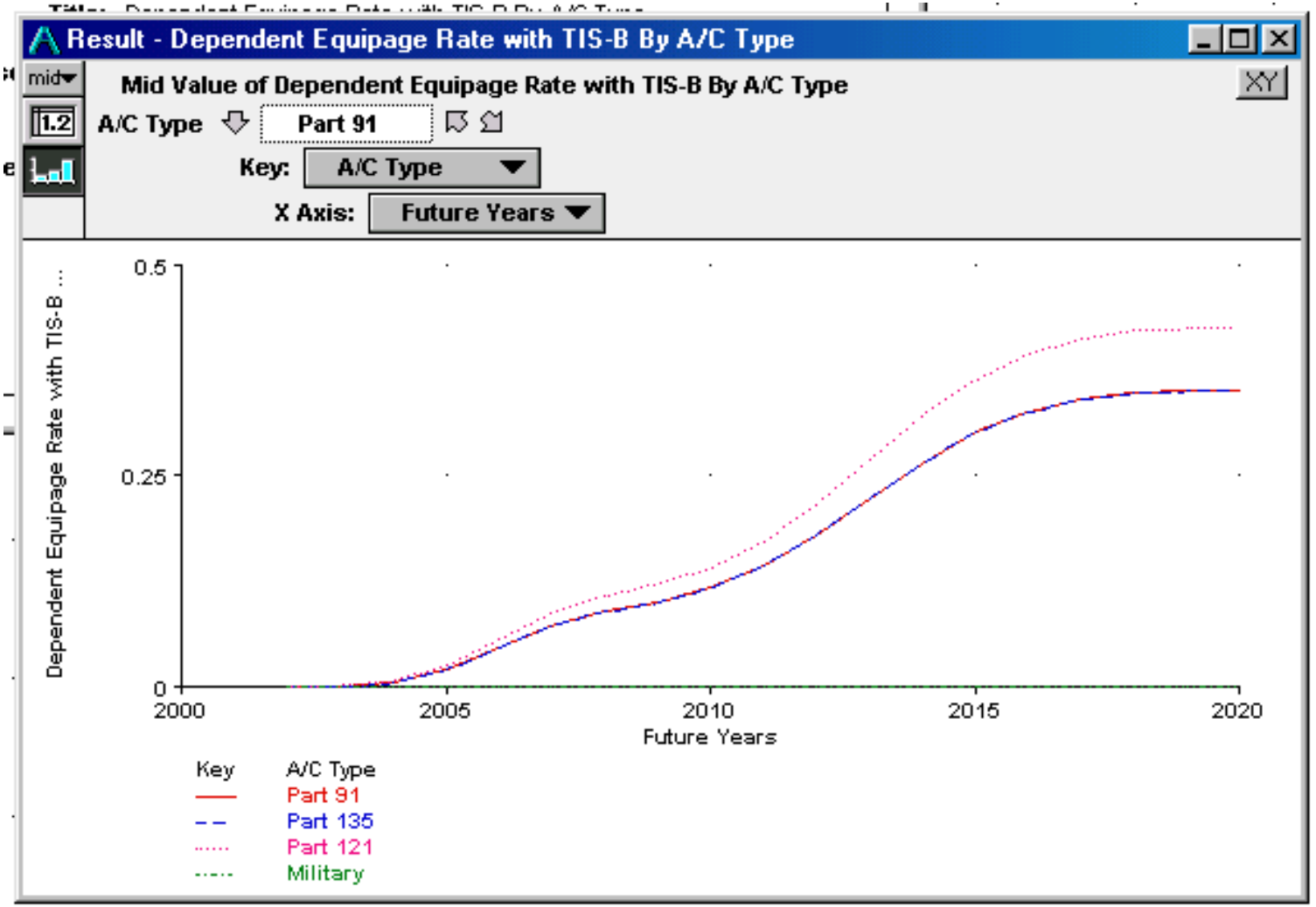
Dependent NAS-wide Equipage for Part 121



Dependent NAS-wide Equipage w/ TIS-B for Part 91



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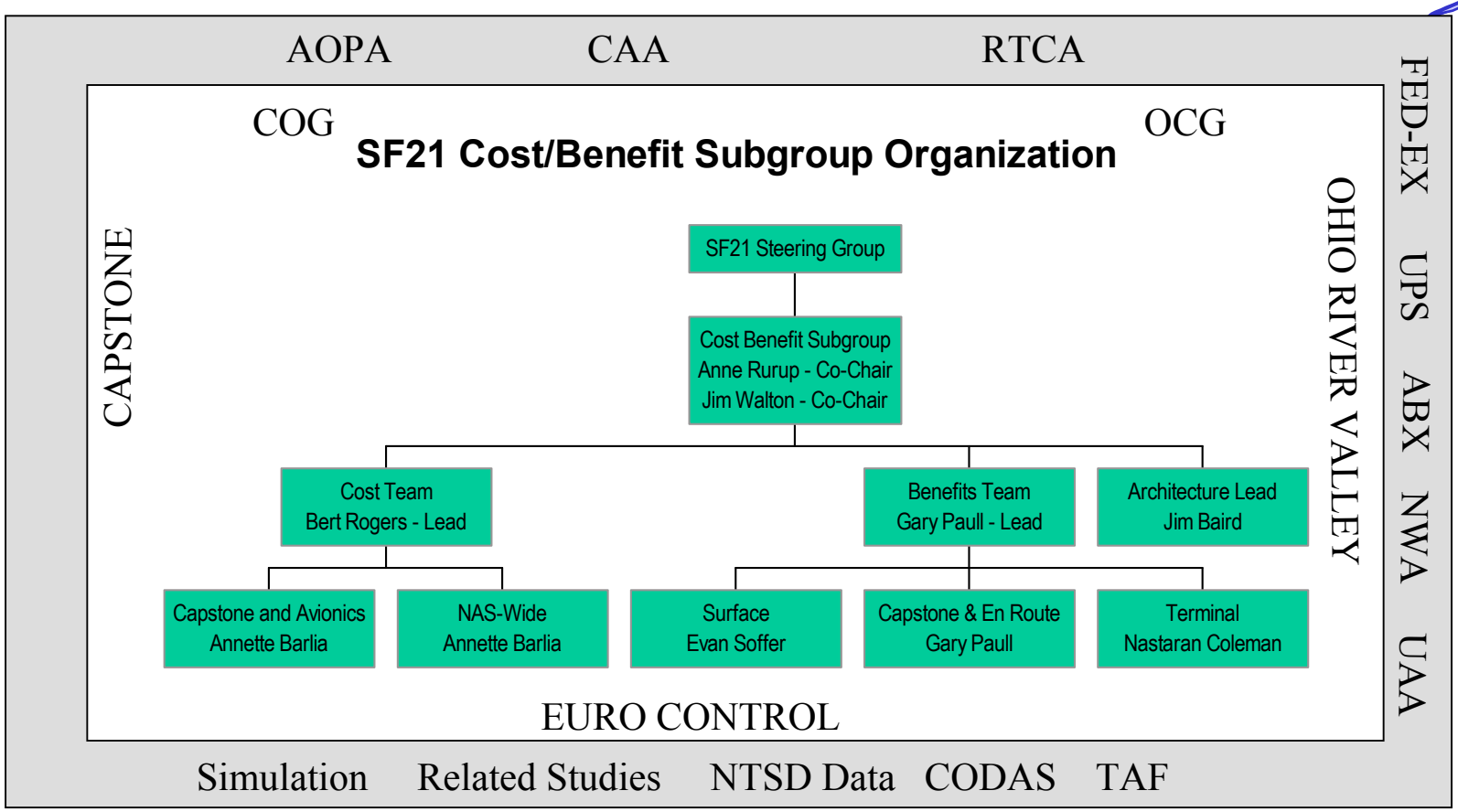
SF21Cost Benefit Subgroup Organizations



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